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Pesticide Fact Sheet No. 199: Cypermethrin

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This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the the following actions has occurred:

1. Issuance or reissuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

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Pesticides, regulations, Chemical Information Fact Sheet, Use Patterns, science findings.

b. Identifiers/Open-Ended Terms

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Pesticide Fact Sheet

Name of Chemical: Cypermethrin
Reason for Issuance: Registration Update
Date Issued: January 3, 1989
Fact Sheet Number: 199

1. Description of Chemical

Generic Name: (+/-)alpha-cyano-(3-phenoxyphenyl)methyl(+)-cis,trans-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate* [containing 14% 1S-cis-S, 1R-cis-R, 1S-trans-S and 1R-trans-R and 11% 1R-cis-S, 1S-cis-R, 1R-trans-S and 1S-trans-R). . . .]
Common Name: Cypermethrin
Trade Names: Ammo™; Cymbush®; Demon®; Cynoff™
Other Names: Barricade; CCN52; Cymperator; Cyperkill; Folcord; Kafil; Super; NRDC 149; Siperin; Ripcord
EPA Shaughnessy Code: 109702
Chemical Abstracts Service (CAS) Number: 66841-24-5
Year of Initial Registration: 1984
Pesticide Type: Pyrethroid-like; Insecticide/Miticide
Chemical Family: Pyrethroid
Manufacturers: FMC Corporation; ICI Americas, Inc.; Shell International Chemical Company, Ltd. (London)

2. Use Patterns and Formulations

Application Rates: Applied to cotton, lettuce (head) and pecans at a rate up to 0.1 pounds active ingredient per acre. It may also be applied into overhead sprinkler irrigation water. Cypermethrin is also applied by Pest Control Operators as a crack, crevice, and spot spray treatment in and around areas including, but not limited to, stores, warehouses, industrial buildings, houses, apartment buildings, greenhouses, laboratories, and on vessels, railcars, buses, trucks, trailers, and aircraft.

Also it may be used in nonfood areas of schools, nursing homes, hospitals, restaurants, and hotels; and food manufacturing, processing, and servicing establishments; as barrier treatments; and as an insect repellent for horses and ponies.

Usual Carrier: Water and oil

Type of Formulations: 30.6%, 25.3%, and 36.6% emulsifiable concentrate and 88% technical

Limitations:

- Registrations are being extended with an expiration date of June 15, 1989. Tolerances expire December 31, 1989.

- RESTRICTED USE PESTICIDE - Extremely toxic to fish. For retail sale to and use only by Certified Applicators, or persons under their direct supervision, and only for those uses covered by the Certified Applicator's Certification.

- REENTRY STATEMENTS - Do not treat areas while unprotected humans or domestic animals are present in the treatment areas.

  Do not allow entry into treated areas without protective clothing until sprays have dried.

- Do not apply within 21 days of harvest.

- Do not graze livestock in treated orchards or cut treated cover crops for feed.

- CROP ROTATION RESTRICTION - Do not plant rotational crops within 30 days of last application.

3. Science Findings

Cypermethrin, a pyrethroid, is extremely toxic to fish. It is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Cypermethrin has a low toxicity to mammals. EPA's review of the cypermethrin pond study indicated that the data, as presented, were not adequate or scientifically complete to allow the Agency to evaluate the actual impact that the use of cypermethrin would have an aquatic life forms. Therefore, ICI/FMC must repeat this study. The EPA Peer Review Committee completed its evaluation of cypermethrin with respect to its oncogenic potential and concluded that the data available for cypermethrin provide limited evidence of oncogenicity for the chemical in female mice. According to EPA Guidelines for Carcinogen Risk Assessment *(Federal Register* September 24, 1986), the Committee classified cypermethrin as a weak Category C oncogen (possible human carcinogen with limited evidence of carcinogenicity in animals). That is, cypermethrin produced benign lung adenomas at the highest dose level in only one sex and species of animal (female mice) and was not considered strong enough to warrant a "quantitative estimation of human risk."

Chemical/Physical Characteristics of the Technical Grade:

Physical State: Solid

Color: Colorless crystals
Odor: Odorless
Molecular Weight: 416.3
Molecular Formula: $C_{22}H_{19}O_3NCl_2$
Melting Point: 60 to 80 °C
Boiling Point: 170 to 195 °C
Density: 1.249 g CM^3 at 20 °C
Vapor Pressure: 8×10^{-4} at 80 °C; 1×10^{-7} at 20 °C
Solubility in Various Solvents:

Water	4 ppb
Base	as water
Acid	as water
Propylene glycol	insoluble (less than 0.5%)
Methanol	very soluble (approx. 75%)
Acetone	completely miscible
Cyclohexanone	completely miscible
Hexane	slightly soluble (7%)
Xylene	completely miscible
Methylene dichloride	completely miscible

Stability - as neat material: No detectable decomposition at normal ambient temperatures and for at least 3 months at 50 °C to date

- as dilute aqueous solution: Slowly hydrolyzes at pH 7 and below. Hydrolyzes more rapidly at pH 9.

Slow photodegradation in sterile solution in sunlight (< 10% in 32 days).

Toxicology Characteristics of the Technical Grade:

- o Acute Oral LD_{50} - Rat: LD_{50} = 247 (187-326) mg/kg (males)
  LD_{50} = 309 (150-500) mg/kg (females)
- o Acute Dermal LD_{50} - Rabbit: LD_{50} > 2460 mg/kg
- o Primary Dermal Irritation - Rabbit: PIS = 0.71 (not irritating)
- o Primary Eye Irritation - Rabbit: Mild irritation
- o Skin Sensitization - Guinea Pig: May cause allergic skin reactions
- o Subchronic Oral - Rat: NOEL of 75 ppm for pharmacological effects. NOEL of 150 ppm for toxic effects.

- Chronic Toxicity - Rat: NOEL = 150 ppm
  LEL = 1500 ppm (HDT)

- Oncogenicity - 24-Month Mouse: Positive neoplastic response in lung tissue. Increased incidence of benign adenomas in females (only), statistically significant at 1600 ppm (HDT). No evidence of oncogenicity in the rat at up to 1500 ppm (HDT).

- Teratogenicity - Rabbit: Not teratogenic at 30 mg/kg/day. (HDT).
  - Rat: Not teratogenic at 70 mg/kg/day (HDT).

- Reproduction - 3-Generation Rat: NOEL for adverse reproductive effects = 750 ppm (HDT), NOEL for systemic effects = 50 ppm, LEL = 150 ppm (decreased body weight gain in maturing pups).

- Mutagenicity - Ames Test: Not mutagenic.

- Mutagenesis - Host-Mediated Assay: Not mutagenic at 50 mg/kg.

- Mutagenesis - Dominant Lethal: Not mutagenic at 25 mg/kg.

Physiological and Biochemical Characteristics:

The mode of action in biological systems is stomach and contact exhibiting neurotoxicological characteristics typical of pyrethroid insecticides. Slight repellent effect.

Foliar Absorption - N/A.

Translocation - N/A.

Environmental Characteristics:

Adequate data are sufficent to define the fate of cypermethrin in the environment. Cypermethrin is stable to hydrolysis, with an estimated T 1/2 exceeding 50 days at environmentally expected temperatures and pH values. Cypermethrin is extremely stable to photolysis in water with an estimated T 1/2 exceeding 100 days at environmentally expected temperatures and pH values. Photoproducts produced included DCVA, 3-phenoxybenzaldehyde, and 3-phenoxybenzoic acid. Cypermethrin photodegrades rapidly on soil surfaces (T 1/2: 8 to 16 days) to many photoproducts, the major ones identified as 3-phenoxybenzoic acid and compound XIV. Cypermethrin degrades in soil under laboratory conditions. The rate is more rapid on sandy clay and sandy loam soils than on clay soils and more rapid on soils lower in organic matter content and cation exchange capacity under all aerobic conditions. The T 1/2 in aerobic

soils ranged from 2 to 8 weeks. In sterile aerobic soils, cypermethrin degraded with a T 1/2 of 20 to 25 weeks indicating that microbes play a signicant role in soil degradation. Cypermethrin degraded more slowly under anaerobic or waterlogged conditions with the major metabolite 3-phenoxybenzoic acid produced. Under aerobic conditions the major metabolites produced were DCVA and 3-phenoxybenzoic acid. Cypermethrin does not leach significantly in soil. It has a low solubility in water (0.2 ppm) and, consequently, high adsorption characteristics. The leaching potential for its degradates may be higher. Under field conditions, runoff of cypermethrin has been shown to occur to some degree and was probably due to physical transport of the solid particles via erosion. Cypermethrin itself degrades rapidly in the field with a T 1/2 of 4 to 12 days. The persistence of the major aerobic soil metabolites is not known. Both accumulation and depuration of cypermethrin residues will occur in trout and catfish. Bioconcentration factors of approximately 1200X were calculated in rainbow trout in a flowthrough study., The data requirement for accumulation of cypermethrin in rotational crops has not been satisfactorily completed.

Ecological Effects Characteristics:

- Avian acute oral LD_{50} - Mallard Duck: > 4640 mg/kg
- Avian dietary LC_{50} - Mallard Duck and Bobwhite Quail: LC_{50} > 20,000 ppm
- Avian reproduction - Mallard Duck and Bobwhite Quail: NOEL > 50 ppm (HDT)
- Fish acute 96-hour LC_{50} - Rainbow Trout = 0.82 ppb
- Fish acute 96-hour LC_{50} - Bluegill Sunfish = 1.78 ppb
- Aquatic invertebrate acute LC_{50} - *Daphnia magna* = 0.26 ppb

Tolerance Assessments:

Section 408 tolerances under the Federal Food, Drug, and Cosmetic Act are established until December 31, 1989 for residues of the insecticide cypermethrin [(+/-)alpha-cyano-(3-phenoxyphenyl) methyl (+-cis,trans-3-(2,2-dichloroethenyl)-2 panecarboxylate] and its metabolites* 3-PB Acid and DCVA in or on the following raw agricultural commodities:

Commodity	ppm
Cattle, fat	0.05
Cattle, meat	0.05
Cattle, meat byproducts	0.05

Commodity	ppm
Cottonseed	0.5
Goats, fat	0.05
Goats, meat	0.05
Goats, meat byproducts	0.05
Hogs, fat	0.05
Hogs, meat	0.05
Hogs, meat byproducts	0.05
Horses, fat	0.05
Horses, meat	0.05
Horses, meat byproducts	0.05
Lettuce (head)	10.00
Milk	0.05
Pecans*	0.05
Sheep, fat	0.05
Sheep, meat	0.05
Sheep, meat byproducts	0.05

The acceptable daily intake (ADI) is calculated to be 0.01 mg/kg/day based on a dog study with a NOEL of 1.0 mg/kg/day and using a safety factor of 100. The maximum permissible intake (MPI) is calculated to be 0.60 mg/kg/day for a 60-kg person. Published tolerances result in a theoretical maximum residue contribution (TMRC) of 0.002773 mg/kg bwt/day. The existing TMRC is equivalent to 27.7 percent of the ADI. No additional data are required to support the current crop tolerances listed in 40 CFR 180.418.

4. Summary of Regulatory Position and Rationale

Adequate data are available to assess the acute and chronic toxicological effects of cypermethrin to humans. The Agency's review of the field study (§72-7) found that the data, as presented, were not scientifically adequate nor sufficiently complete to allow the Agency to evaluate the actual impact that the use of cypermethrin would have on aquatic life forms. ICI/FMC disagreed with the Agency's conclusion and will submit additional information necessary in order for the Agency to complete the risk assessment.

On the basis of this information, EPA seriously considered whether to issue new conditional registrations for cypermethrin. Based on the information submitted, on January 3, 1989 the Agency issued new conditional registrations of cypermethrin which will expire on June 15, 1989.

The Agency issued these new conditional registrations for this short period of time to ICI and FMC in light of their agreement to:

a. Submit all data generated in the course of the cypermethrin Alabama pond study pertaining to runoff and residues in water and sediment to the Agency by January 1989.

b. Submit all other data now in existence and not previously submitted to the Agency, as well as all other data generated in the future in the course of the cypermethrin Alabama pond study, as soon as is practical.

c. Conduct an aquatic mesocosm study (a simulated 2-year field study) for which EPA will develop and provide the protocol no later than April 15, 1989, in case ICI/FMC do not persuade EPA that the current cypermethrin pond study is acceptable.

d. Within 30 days of receipt of an EPA protocol for an aquatic mesocosm study, provide the Agency with written unconditional acceptance of the protocol and an unconditional commitment to conduct the study through completion. For any modification of the protocol to be valid, it must be agreed to by EPA within the above-mentioned 30-day period.

EPA has concluded that the continual use of cypermethrin for this short period of time will not cause a significant increase in the risk of adverse effects to the environment.

The Delaney Clause in section 409 of the Federal Food, Drug, and Cosmetic Act bars the establishment of food additive regulations for substances which induce cancer in man or test animals. Since cypermethrin has been found to produce an oncogenic response in test animals, no 409 tolerances will be granted. Cypermethrin as parent does not leach significantly in soil. At this time, there are no concerns for ground water contamination.

5. Summary of Major Data Gaps

Simulated and/or actual field study (§72-7)

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